

Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

### AMENDMENTS TO THE CLAIMS

1. (currently amended) A method for minimizing clock feedthrough effect when switching off a switched capacitor circuit in an oscillator circuit, the method comprising:

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providing a plurality of differently sized positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements, wherein the positive side first node is connected to a positive side capacitor and the positive side capacitor is further connected to an oscillator node in the oscillator circuit; ~~and~~

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sequencing the control signals such that the positive side switch elements are switched off sequentially with a smallest switch element being switched off last when switching the switched capacitor circuit to an off state; and

when switching the switched capacitor circuit to an off state, providing a means for making the smallest positive side switch element gradually switch off.

20 2. (original) The method of claim 1, wherein the plurality of positive side switch elements is a plurality of differently sized positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements; and

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when switching the switched capacitor circuit to an off state, sequencing the control signals such that the positive side switch elements are switched off in decreasing

Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

order based on switch size, whereby the largest switch element is switched off first and the smallest switch element is switched off last.

3. (cancelled)

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4. (original) The method of claim 3, wherein each switch element is a transistor and the means for making the smallest positive side switch element gradually switch off comprises a low-pass filter connected to the first control terminal of the smallest positive side switch element.

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5. (original) The method of claim 3, wherein the positive side second node is ground and the switch elements comprise NMOS transistors.

6. (previously presented) The method of claim 2, further comprising:

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for each switch element in the plurality of differently sized positive side switch elements, providing a corresponding negative side switch element having substantially the same size as the positive side switch element for selectively connecting a negative side first node to a negative side second node depending upon the control signal applied to the first control terminal of the positive side switch element, wherein the negative side first node is connected to a negative side capacitor.

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7. (original) The method of claim 6, further comprising:

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providing a center switch element for selectively connecting the positive side first node to the negative side first node depending upon a center control signal applied to the third control terminal of the center switch element; and

Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

when switching the switched capacitor circuit to an off state, sequencing the control signals such that the center switch element is switched off first and then the positive side switch elements and the corresponding negative side switch elements are  
5 switched off in decreasing order based on size.

8. (original) The method of claim 6, further comprising when switching the switched capacitor circuit to an off state, providing a means for making the smallest positive side switch element and its corresponding negative side switch element gradually  
10 switch off.

9. (original) The method of claim 8, wherein each switch element is a transistor and the means for making the smallest positive side switch element and its matched negative side switch element gradually switch off comprises a low-pass filter  
15 connected to the first control terminal of the smallest positive side switch element and its matched negative side switch element.

10. (original) The method of claim 8, wherein the positive side second node is ground, the negative side second node is ground, and the switch elements comprise NMOS  
20 transistors.

11. (currently amended) A switched capacitor circuit capable of minimizing clock feedthrough effect in an oscillator circuit comprising:  
25 a plurality of positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements, wherein the positive side first node is connected to a positive side capacitor and the positive side capacitor is

Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

further connected to an oscillator node in the oscillator circuit; ~~and~~

a sequence controller electrically connected to the positive side switch elements for generating the control signals to switch off the differently sized positive side switch elements sequentially such that a smallest switch element is switched off last; and

means for making the smallest positive side switch element gradually switch off.

12. (original) The switched capacitor circuit of claim 11, wherein:

the plurality of positive side switch elements is a plurality of differently sized positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements; and

the sequence controller electrically connected to the differently sized positive side switch elements is for generating the control signals to switch off the differently sized positive side switch elements in decreasing order based on switch size.

13. (cancelled)

14. (original) The switched capacitor circuit of claim 13, wherein each switch element is a transistor and the means for making the smallest switch element gradually switch off comprises a low-pass filter connected to the first control terminal of the smallest positive side switch element.

15. (original) The switched capacitor circuit of claim 14, wherein the second positive side node is ground and the positive side switch elements comprise NMOS

Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

transistors.

16. (original) The switched capacitor circuit of claim 12, further comprising:

5       for each switch element in the plurality of differently sized positive side switch  
elements, a corresponding negative side switch element having substantially the  
same size as the positive side switch element for selectively connecting a negative  
side first node to a negative side second node depending upon the control signal  
applied to the first control terminal of the positive side switch element, wherein the  
10       negative side first node is connected to a negative side capacitor.

17. (original) The switched capacitor circuit of claim 16, further comprising:

15       a center switch element for selectively connecting the positive side first node to the  
negative side first node depending upon a center control signal;

      wherein the sequence controller is further connected to the center switch element  
and generates a center control signal, and the sequence controller switches off the  
center switch element first and then the positive side switch elements are switched  
20       off in decreasing order based on switch size.

18. (original) The switched capacitor circuit of claim 16, further comprising a means for  
making the smallest positive side switch element and its corresponding negative  
side switch element gradually switch off.

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19. (original) The switched capacitor circuit of claim 18, wherein each switch element is  
a transistor and the means for making the smallest positive side switch element and  
its matched negative side switch element gradually switch off comprises a low-pass

Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

filter connected to the first control terminal of the smallest positive side switch element and its corresponding negative side switch element.

- 5 20. (original) The switched capacitor circuit of claim 18, wherein the positive side second node is ground, the negative side second node is ground, and the positive side switch elements, the negative side switch elements, and the center switch element comprise NMOS transistors.
- 10 21. (new) A method for minimizing clock feedthrough effect when switching off a switched capacitor circuit, comprising:
- 15 providing a plurality of differently sized positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements, wherein the positive side first node is connected to a positive side capacitor;
- 20 for each switch element in the plurality of differently sized positive side switch elements, providing a corresponding negative side switch element having substantially the same size as the positive side switch element for selectively connecting a negative side first node to a negative side second node depending upon the control signal applied to the first control terminal of the positive side switch element, wherein the negative side first node is connected to a negative side capacitor; and
- 25 when switching the switched capacitor circuit to an off state, sequencing the control signals such that the positive side switch elements are switched off sequentially.

Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

22. (new) The method of claim 21, wherein the plurality of positive side switch elements is a plurality of differently sized positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements;  
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when switching the switched capacitor circuit to an off state, sequencing the control signals such that the positive side switch elements are switched off in decreasing  
10 order based on switch size, whereby the largest switch element is switched off first and the smallest switch element is switched off last.
23. (new) The method of claim 22, further comprising when switching the switched capacitor circuit to an off state, providing a means for making the smallest positive  
15 side switch element gradually switch off.
24. (new) The method of claim 23, wherein each switch element is a transistor and the means for making the smallest positive side switch element gradually switch off comprises a low-pass filter connected to the first control terminal of the smallest  
20 positive side switch element.
25. (new) The method of claim 23, wherein the positive side second node is ground and the switch elements comprise NMOS transistors.
- 25 26. (new) The method of claim 21, further comprising:  
  
providing a center switch element for selectively connecting the positive side first node to the negative side first node depending upon a center control signal applied

Appl. No. 10/709,461

Amdt. dated Aug. 03, 2005

Reply to Office action of May 20, 2005

to the third control terminal of the center switch element; and

5 when switching the switched capacitor circuit to an off state, sequencing the control signals such that the center switch element is switched off first and then the positive side switch elements and the corresponding negative side switch elements are switched off in decreasing order based on size.

10 27. (new) The method of claim 26, further comprising when switching the switched capacitor circuit to an off state, providing a means for making the smallest positive side switch element and its corresponding negative side switch element gradually switch off.

15 28. (new) The method of claim 27, wherein each switch element is a transistor and the means for making the smallest positive side switch element and its matched negative side switch element gradually switch off comprises a low-pass filter connected to the first control terminal of the smallest positive side switch element and its matched negative side switch element.

20 29. (new) The method of claim 27, wherein the positive side second node is ground, the negative side second node is ground, and the switch elements comprise NMOS transistors.

25 30. (new) A switched capacitor circuit capable of minimizing clock feedthrough effect, comprising:  
a plurality of positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements, wherein the positive side first



Appl. No. 10/709,461  
Amdt. dated Aug. 03, 2005  
Reply to Office action of May 20, 2005

node is connected to a positive side capacitor;

5 for each switch element in the plurality of differently sized positive side switch elements, a corresponding negative side switch element having substantially the same size as the positive side switch element for selectively connecting a negative side first node to a negative side second node depending upon the control signal applied to the first control terminal of the positive side switch element, wherein the negative side first node is connected to a negative side capacitor; and

10 a sequence controller electrically connected to the positive side switch elements for generating the control signals to switch off the differently sized positive side switch elements sequentially.

31. (new) The switched capacitor circuit of claim 30, wherein:

15 the plurality of positive side switch elements is a plurality of differently sized positive side switch elements for selectively connecting a positive side first node to a positive side second node depending upon a control signal applied to a first control terminal of each of the switch elements; and

20 the sequence controller electrically connected to the differently sized positive side switch elements is for generating the control signals to switch off the differently sized positive side switch elements in decreasing order based on switch size.

25 32. (new) The switched capacitor circuit of claim 31, further comprising a means for making the smallest positive side switch element gradually switch off.

33. (new) The switched capacitor circuit of claim 32, wherein each switch element is a

Appl. No. 10/709,461

Amdt. dated Aug. 03, 2005

Reply to Office action of May 20, 2005

transistor and the means for making the smallest switch element gradually switch off comprises a low-pass filter connected to the first control terminal of the smallest positive side switch element.

- 5 34. (new) The switched capacitor circuit of claim 32, wherein the second positive side node is ground and the positive side switch elements comprise NMOS transistors.

35. (new) The switched capacitor circuit of claim 30, further comprising:

- 10 a center switch element for selectively connecting the positive side first node to the negative side first node depending upon a center control signal;

- wherein the sequence controller is further connected to the center switch element and generates a center control signal, and the sequence controller switches off the center switch element first and then the positive side switch elements are switched off in decreasing order based on switch size.
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36. (new) The switched capacitor circuit of claim 35, further comprising a means for making the smallest positive side switch element and its corresponding negative side switch element gradually switch off.
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37. (new) The switched capacitor circuit of claim 36, wherein each switch element is a transistor and the means for making the smallest positive side switch element and its matched negative side switch element gradually switch off comprises a low-pass filter connected to the first control terminal of the smallest positive side switch element and its corresponding negative side switch element.
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38. (new) The switched capacitor circuit of claim 36, wherein the positive side second

Appl. No. 10/709,461

Amdt. dated Aug. 03, 2005

Reply to Office action of May 20, 2005

node is ground, the negative side second node is ground, and the positive side switch elements, the negative side switch elements, and the center switch element comprise NMOS transistors.

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